

**Main Supervisors: Dr Rolando Ferrini and Dr Oscar Fernandez** - CSEM Center Muttentz

**Academic Supervisor: Professor Christian Cajochen** - Centre for Chronobiology at the University of Basel

### PhD Project

The objective of the proposed PhD project is to investigate and quantify visual and non-visual effects produced by LED lighting on humans across a wide spectral and photometric parameter space. The proposed research will combine the vast experience and facilities of Professors Cajochen and Scartezzini on the physiological aspects of lighting with those of CSEM in the field of integrated light management solutions for solid-state lighting.

**The student will develop a LED-based luminaire and investigate the chronobiological effects in the laboratories of Professor Cajochen at the Centre for Chronobiology in Basel.**

In the initial phase of the project, the parameter space of interest will be defined with respect to spectral tuning, achromatic dimming and beam steering/shaping.

In a later stage, he/she will design and develop light management structures for beam shaping and spectral tuning so that the previously identified illumination parameter space can be reproduced as well as the electronics necessary to provide different illumination conditions in a dynamic and highly controllable fashion. This part of the Thesis will account for around 75% of the total work.

**The fabricated luminaire will also be used to study visual (e.g. comfort) and non-visual effects of different artificial/daylighting combinations.** In this regard, the student will be directly engaged on the development of a spectral sensing platform to realize a smart *active human centric* lighting solution. This part of the work will be supported by Professor Scartezzini at the *Solar Energy and Building Physics Laboratory at EPFL* and accounts for the remaining 25% of the effort.

The results obtained from the described experiments will be conveniently analysed in order to draw relevant conclusions and make useful recommendations.

During the proposed work, collaborations can be envisaged with industrial actors in the region such as REGENT LIGHTING for the integration of the developed components into a luminaire and BASF with regards to their proprietary color changing foils for spectral tuning.

**We strongly believe that the results of the proposed research will be of scientific interest as well as of enormous commercial value for the companies in the Professional Lighting Business.**

The PhD student will perform the largest part of his/her research at CSEM facilities in Basel. In order to comply with legal and insurance regulations he/she will be an employee of CSEM.



*Top) 20x20cm<sup>2</sup> LED-based lighting module with (left) and without (right) a multilayer light management solution developed by CSEM in the European project LASSIE-FP7. The multilayer solution transforms the non-homogeneous light pattern produced by the point-like LED sources into a spatially uniform emitting surface. The module height, 18mm is lower than the LED pitch (30mm). The light engine contains white, red and green LEDs for color tuning. Bottom) Emitting surface of the module tuned to different colours demonstrates that CSEM light management solution offers also excellent light mixing characteristic.*

### Contact

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